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OMEGA ENGINEERING, INC.

An OMEGA Group Company

Model 115

Digital Thermometers

Operator's Manual

WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of 13 months from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal one (1) year product warranty to cover handling and shipping time. This ensures that our customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. Our Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive current, heat, moisture, vibration, or misuse. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

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Return Requests/Inquiries

Direct all warranty and repair requests/inquiries to OMEGA Customer Service Department, telephone number (203) 359-1660. Before returning any instrument, please contact the OMEGA Customer Service Department to obtain an authorized return (AR) number. The designated AR number should then be marked on the outside of the return package.

To avoid processing delays, also please be sure to include:

1. Returnee's name, address, and phone number.
2. Model and Serial numbers.
3. Repair instructions.

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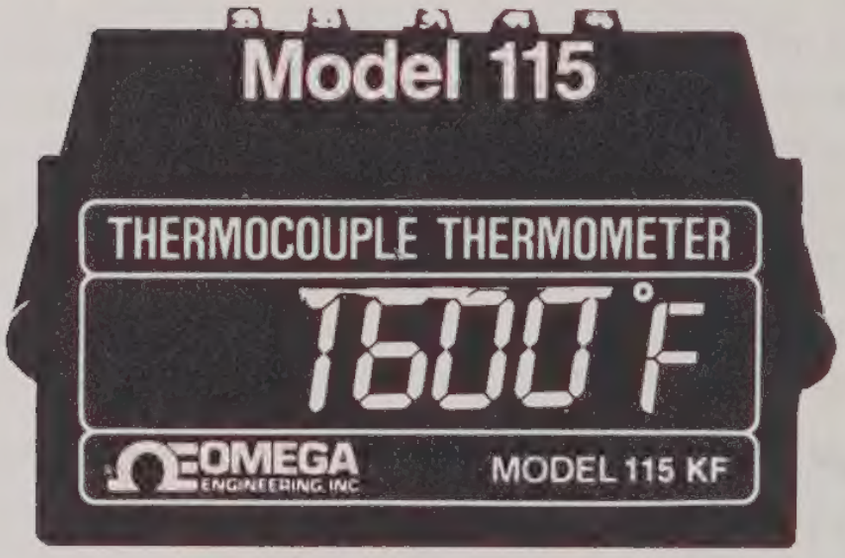

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SECTION 1 INTRODUCTION

1.1 GENERAL DESCRIPTION

The Model 115 Digital Panel Meter is a versatile, high-performance, industrial grade readout for type J, K, T, or E thermocouple sensors. Thermocouple linearization, cold junction compensation, gain, and offset error correction are automatic features of the internal electronics.

The overall temperature range of the Model 115 series extends from –100° to 1999°F (–73° to 1092°C). Each unit varies in individual temperature ranges depending upon thermocouple calibration, as explained in Section 4.

A linearized 1 millivolt per °C or 0.556 millivolt per °F analog output is standard for connection to recorders or other analog devices. Power is selectable for either 115 V ac or 230 V ac, 50/60 Hertz. The case is a rugged, high-impact plastic that meets DIN/NEMA standard dimensions.

1.2 THERMOCOUPLE SELECTION

Thermocouples are available in many forms depending upon the two dissimilar metals used, temperature range, and the application required. Because any two dissimilar metals that are bonded together can theoretically form a thermocouple, the National Bureau of Standards (NBS) sets standards and establishes calibration tables for each thermocouple temperature vs. output voltage. Table 1 shows the thermocouple calibrations and their metallic composition that can be interfaced with the Model 115. Thermocouple calibration must match the Model 115 calibration. For example, a type J unit requires a type J thermocouple.

Each thermocouple type is designated by a letter that is accepted by the American National Standards Institute (ANSI). Also shown in the table are the thermocouple types and the NBS standards that will interface with the Model 115.

Since more than one thermocouple is available for a specific temperature range, refer to the *OMEGA Temperature Measurement Handbook*, or contact OMEGA ENGINEERING, INC. at (203) 359-1660 for assistance.

TABLE 1

THERMOCOUPLES

ANSI Type Thermocouple	Material Type	Range	Readout Accuracy @ 25°C*	Resolution	Model
J	**Iron/Constantan** (Iron vs. Copper Nickel)	– 100° to 760°C	± 2.0°C	1°C	115 JC
		– 100° to 1400°F	± 3.6°F	1°F	115 JF
K	**Chromel/Alumel** (Nickel-Chromium vs. Nickel-Aluminum)	– 50° to 1200°C	± 2.6°C	1°C	115 KC
		– 50° to 1999°F	± 4.7°F	1°F	115 KF
T	**Copper/Constantan** (Copper vs. Copper Nickel)	– 100° to 400°C	± 2.0°C	1°C	115 TC
		– 100° to 750°F	± 3.6°F	1°F	115 TF
E	**Chromel/Constantan** (Nickel Chromium vs. Copper-Nickel)	– 50° to 800°C	± 2.6°C	1°C	115 EC
		– 50° to 1500°F	± 4.7°F	1°F	115 EF

*Readout acccuracy includes all conformity, cold junction compensation, gain, and offset errors.

SECTION 2 INSTALLATION

2.1 UNPACKING

Remove the Packing List to check off actual equipment received. If you have any questions on your shipment, please call OMEGA's Customer Service Department at (203) 359-1660.

Upon receipt of shipment, inspect the container for any signs of damage in transit. Especially take note of any evidence of rough handling. Report any apparent damage immediately to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

2.2 MOUNTING

The Model 115 is mounted in the user's panel of any thickness greater than 0.062" (1.5 mm) and less than 0.187" (4.7 mm). Figure 2-1 illustrates the required cutout dimensions, the front panel bezel size, and the depth needed behind the bezel. Be sure to provide space for cable bend behind the instrument.

1. Slide controller into the panel.
2. Place the clamp tab in the anchor hole on the side of the Model 115 case. (See Figure 2-1.)

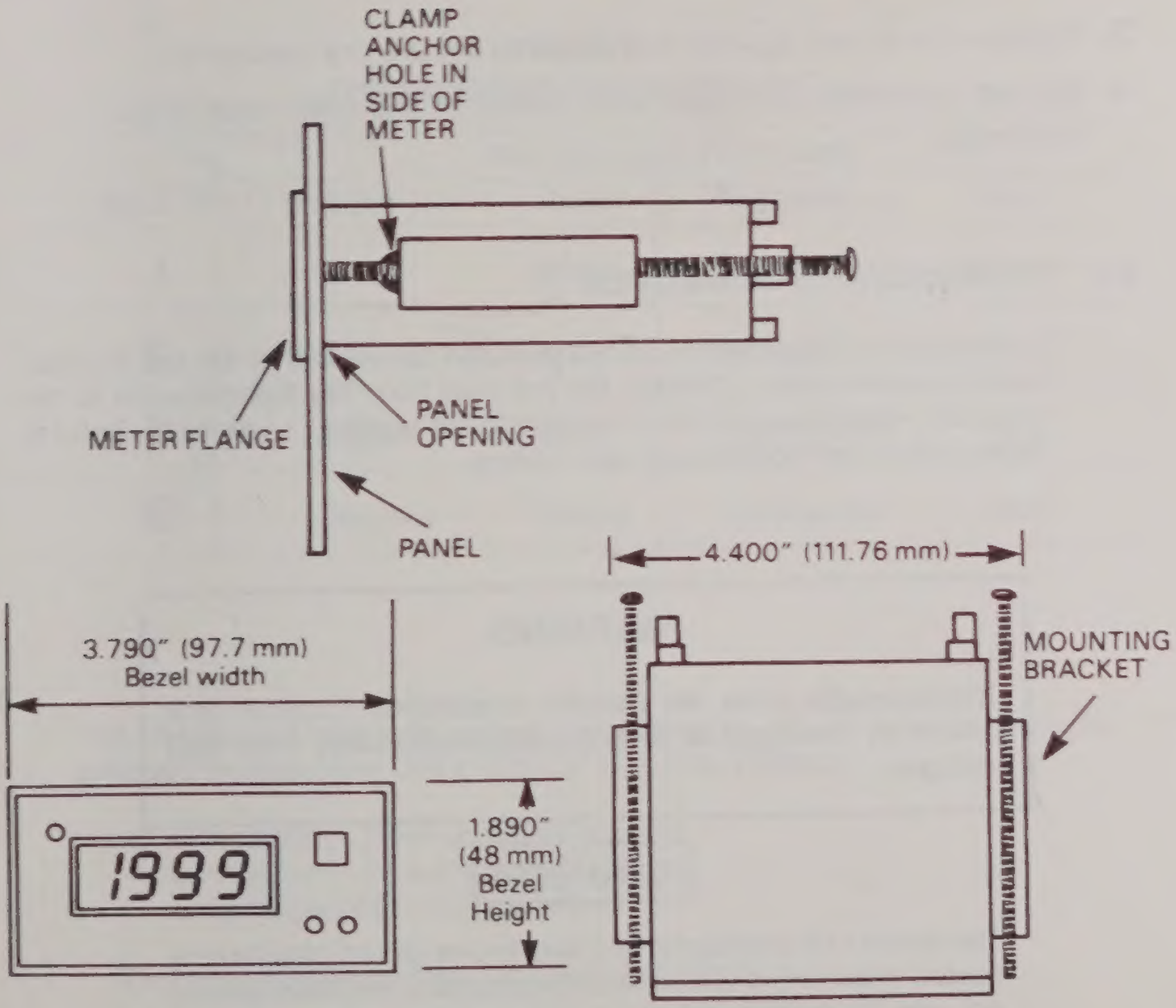


Figure 2-1. Outline and Mounting Dimensions with Clamp Assembly

3. Tighten the screw against the panel to secure the controller.
4. Repeat assembly procedure with clamp on the other side of the controller.

2.3 THERMOCOUPLE CONNECTION

Two solderless screw terminals are provided on the rear of the unit for thermocouple connection. Connect the red lead from the thermocouple to the negative (–) terminal and the other lead to the positive (+) terminal. Refer to Table 2 for proper polarity and color coding.

WARNING

Thermocouple wires are metallic conductors. Extreme care should be exercised to keep thermocouples away from high voltages.

CAUTION

The Model 115 is designed so that only one ground may be connected to the unit. If you must use a grounded thermocouple, do not use the analog output to drive a device whose input is grounded. Measurement errors and possible unit damage could occur if this condition exists.

TABLE 2
THERMOCOUPLE WIRE POLARITY

Symbol	Thermocouple Wire Leads			
	Positive (+)	Color	Negative (–)	Color
J	Iron	White	Constantan	Red
K	Chromel	Yellow	Alumel	Red
T	Copper	Blue	Constantan	Red
E	Chromel	Purple	Constantan	Red

The power input terminals are isolated; therefore, proper grounding can be achieved by grounding *ONLY ONE OF THE FOLLOWING*:

a. negative (–) thermocouple terminal
b. negative (–) analog output terminal
c. digital ground (circuit common)

The instrument can remain "floating" if desired.

Refer to Table 2 for proper polarity of thermocouple wire.

2.4 ANALOG OUTPUT CONNECTION

Two solderless screw terminals are provided on the rear of the instrument for connecting the linearized 1 mV/°C or 0.556 mV/°F analog output to plotters or recorders. See Figures 2-2, 2-3 and 2-4 for possible configurations that may be connected to this output. Figure 2.2 is a simplified schematic for the output.

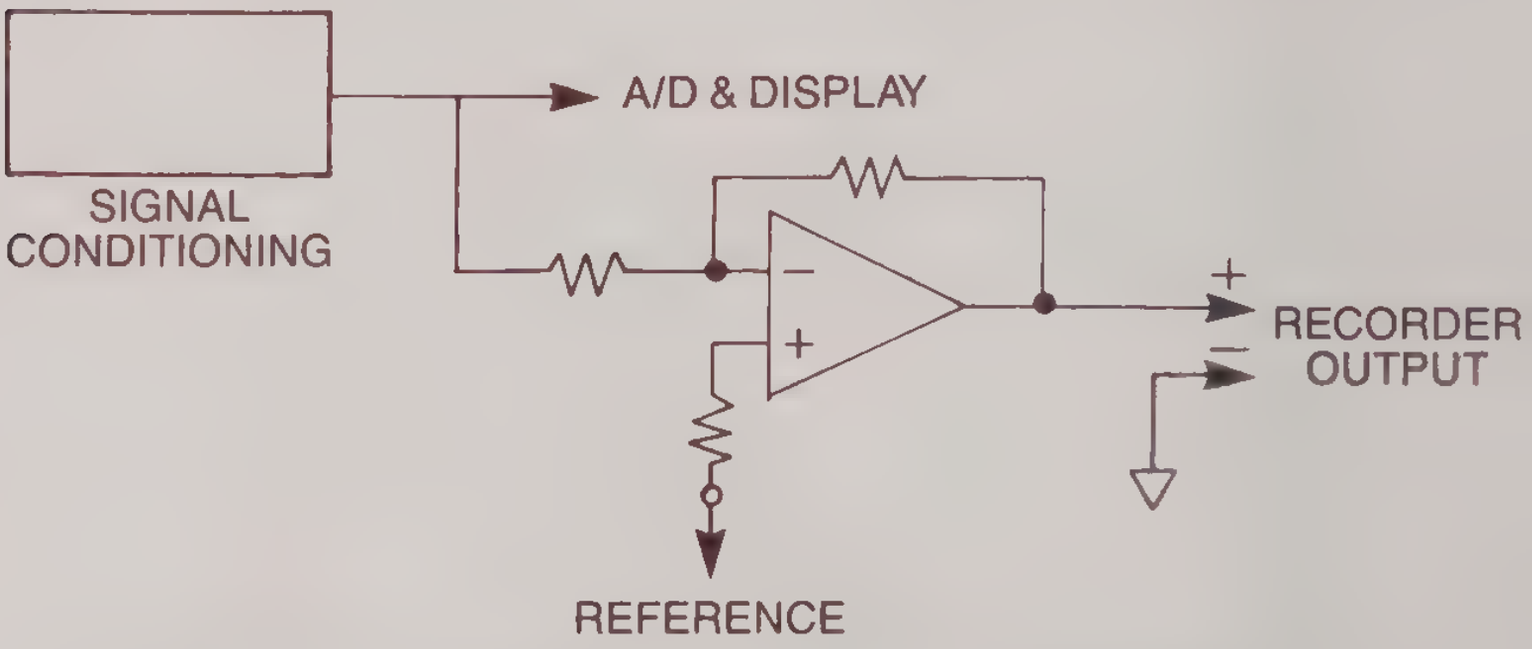


Figure 2-2. Analog Output Simplified Schematic

WARNING

Do not plug unit in until all connections have been made.

CAUTION

Care must be exercised to observe the grounding requirements in paragraph 2.3 so that inaccuracies or possible unit damage is avoided.

2.5 TYPICAL ANALOG OUTPUT APPLICATIONS

A few of the many possible applications of the Model 115 analog output are described in the illustrations that follow. Please note that the Model 115 analog output is designed to drive devices which have floating (ungrounded) inputs with a minimum impedance of 10 k ohm.

Figure 2-3 illustrates the 1 mV/°C analog output of the Model 115 is used to drive a strip chart recorder for long term temperature monitoring.

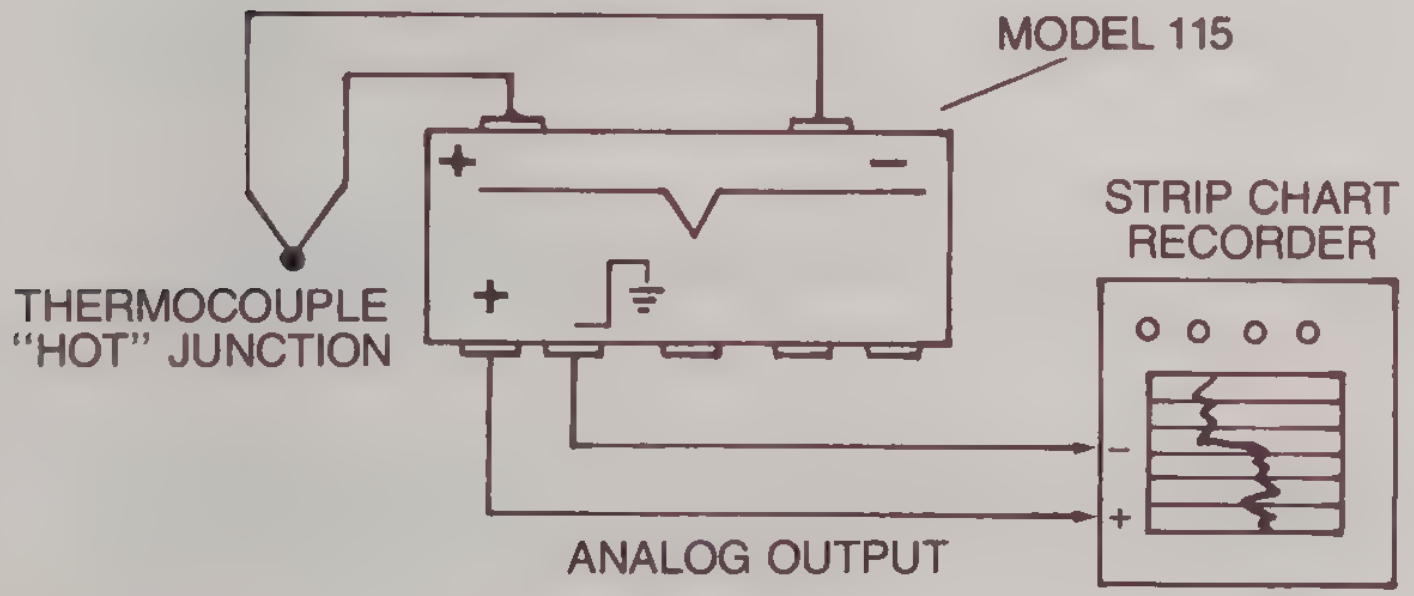


Figure 2-3. Interfacing Analog Output to a Strip Chart Recorder

Figure 2-4 illustrates the analog output of the Model 115 driving a remote analog indicator.

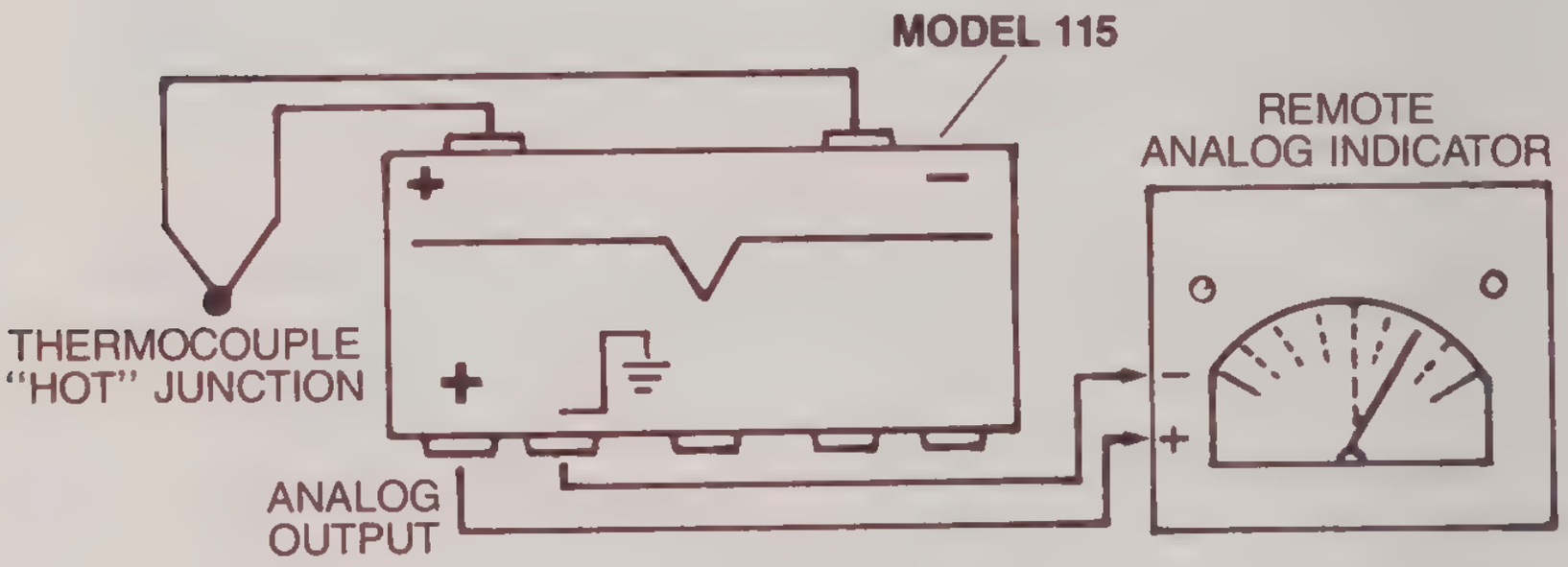


Figure 2-4. Interfacing Analog Output to a Remote Analog Indicator.

Figure 2-5 illustrates the analog output of the Model 115 to interface with a 4 to 20 mA current loop. The signal conditioner is used to amplify the analog output level while the voltage-to-current (V to I) converter interfaces with the loop.

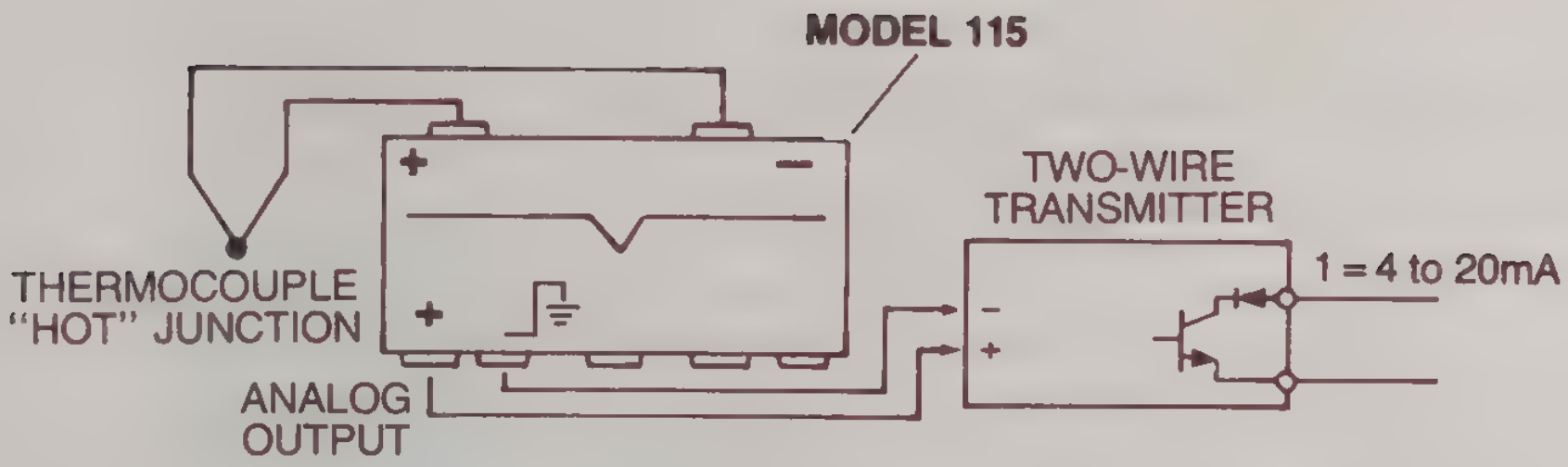


Figure 2-5. Interfacing to a 4 to 20 mA Current Loop

2.6 POWER CONNECTION

WARNING

Ensure that power cord is not plugged in when attaching line voltage to the unit. Do not plug in until installation is complete.

CAUTION

Ensure that strands of wire are neatly secured under screw head to avoid accidental shorting.

The Model 115 is designed so that only one ground may be connected to the unit. If you must use a grounded thermocouple, do not use the analog output to drive a device whose input is grounded. Measurement errors and possible unit damage could occur if this condition is allowed to exist.

Attach wires from line cord to the proper screw terminals depending on input line voltage. Plug unit in and allow 15 minutes to stabilize.

SECTION 3 PRINCIPLES OF OPERATION

3.1 GENERAL THERMOCOUPLE OPERATION

A thermocouple consists of two dissimilar conductors joined together at one end to form the "hot" or measurement junction (T1), with the free end attached to the instruments constituting the "cold" or reference junction (T2). When a temperature difference exists between the measurement and the reference junction, a voltage is generated. Voltage magnitude depends upon the composition of the two conductors and the temperature difference between the measurements and reference junctions. To be able to determine the measurement temperature (T1), the reference junction temperature must be known. The most common method is to define the voltage generated by a thermocouple at various temperatures as shown in Figure 3-1, based upon a fixed cold junction temperature of melting ice, 32°F (0°C).

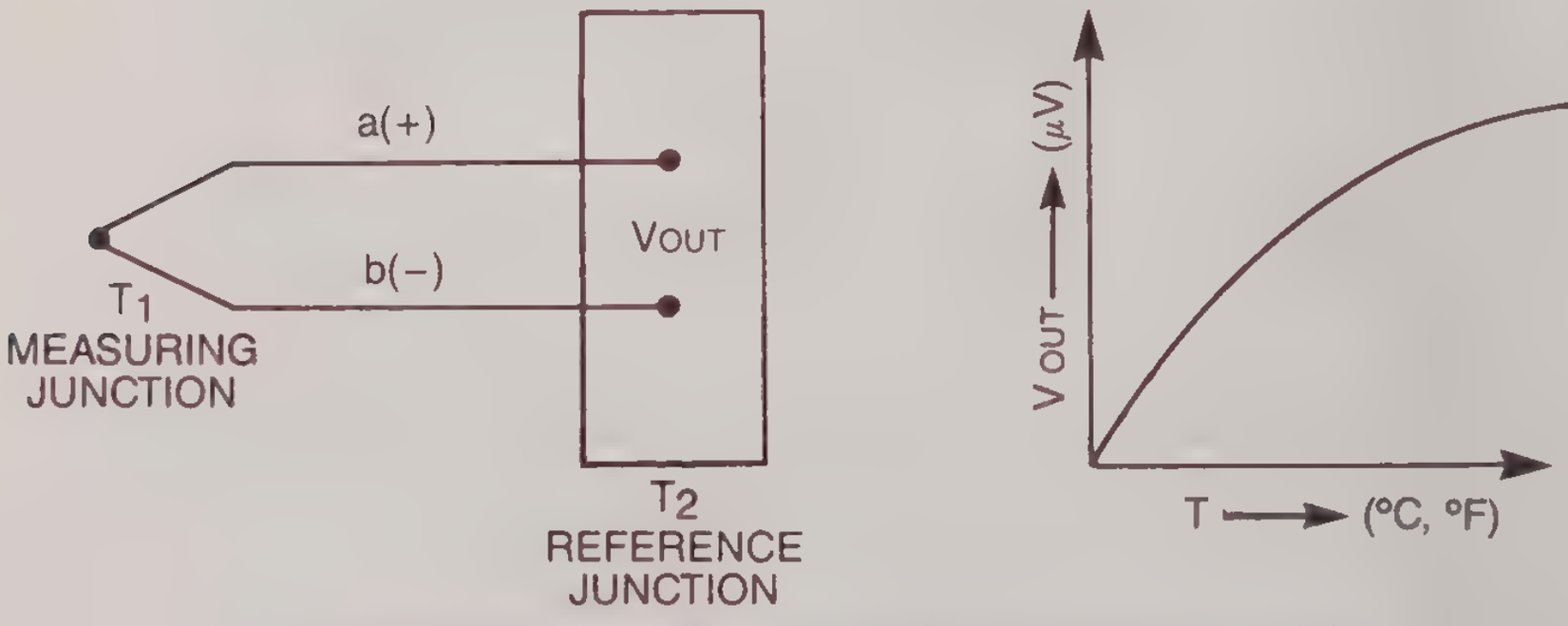


Figure 3-1. Basic Thermocouple Performance Curve

3.2 THERMOCOUPLE "HOT" AND "COLD" JUNCTIONS

The physical phenomenon that results in the voltage generated by a heated junction is not confined to the metals identified in the NBS tables. Any junction of dissimilar metals which has a different temperature at one end of the conductors generates a voltage output.

To distinguish among different thermocouples, the measuring junction is called the "HOT" junction, while the connections to the measuring circuit or device are called "REFERENCE" or "COLD" junctions, even though the hot junction may be many degrees cooler than the cold one in some applications.

The NBS calibration data for any thermocouple is developed under very carefully controlled standardized test conditions. The data published in the NBS Monograph 125 (available from OMEGA Press) has been developed under conditions where the reference junctions are kept at an ambient temperature of distilled water and ice bath under sea level pressure, assuring a temperature at the reference junction of 32°F (0°C); hence, the designation "COLD" junction. Figure 3-2 illustrates the standard calibrating circuit in schematic form. The published results express the output voltage referenced to the value at 32°F (0°C).

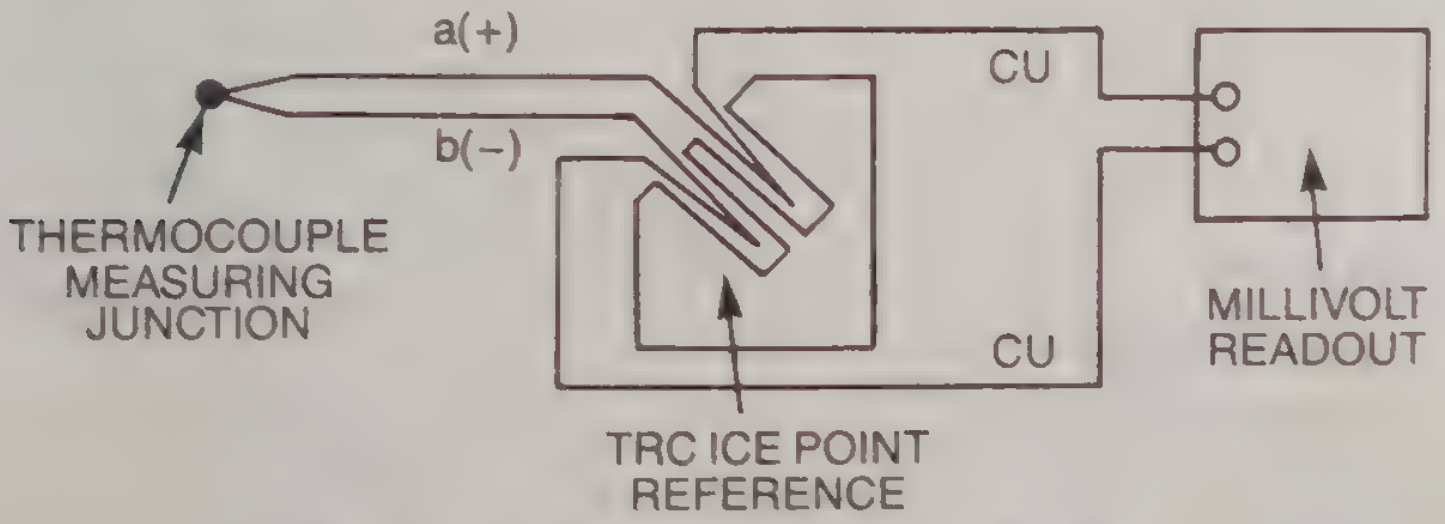


Figure 3-2. Standard Calibration Circuit

3.3 LINEARIZATION & COLD JUNCTION COMPENSATION

The Model 115 uses a digitizing technique that requires an input signal scaled to 1 mV/°C or °F. Therefore, before the analog-to-digital circuitry in the Model 115 is effective, the thermocouple output voltage must be conditioned for three factors:

1. The variable cold junction temperature
2. The nonlinearity of the thermocouple response function
3. The desired temperature scale

The ambient temperature of the cold junction is compensated for by automatically introducing an appropriately scaled voltage proportional to the temperature of the input connector. This scaled voltage offsets the input signal by the correct amount for the particular thermocouple type. This compensation, combined with the thermocouple voltage, provides a compensated voltage (ice point reference signal) to be linearized by the instrument.

The thermocouple voltage is linearized with a number of linear segments by programming the gain of the input signal conditioning amplifier as a function of the input voltage. In effect, the slope (amplifier gain) between selected temperature-voltage points is made equal to the slope of a straight line segment between these points. The segment is also offset to a "best fit" to reduce the non-conformity to a minimum within the range of the segment. The result, expressed as the "conformity" error, is illustrated for one segment in Figure 3-3.

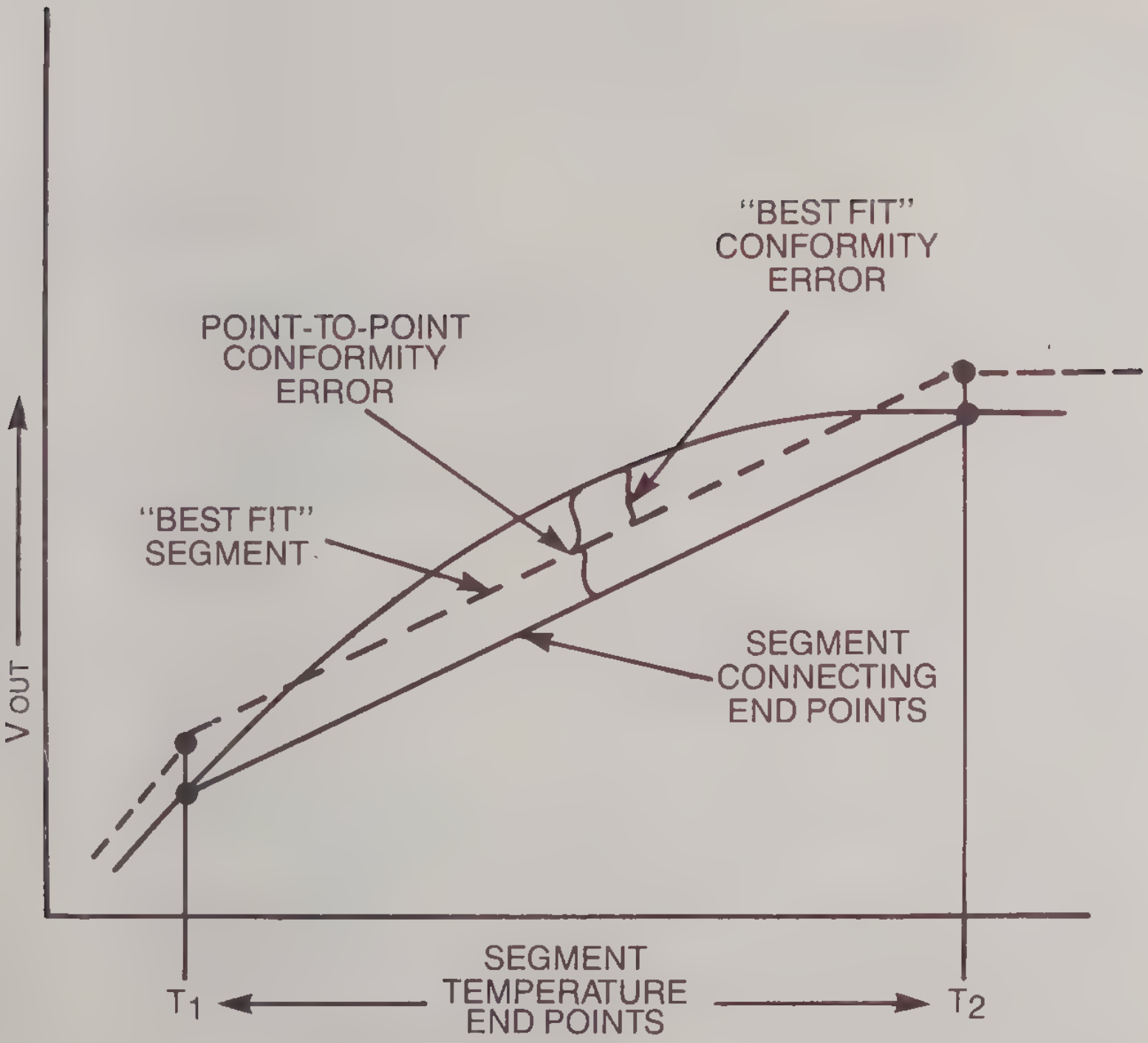


Figure 3-3. Linearization and Conformity Error

SECTION 4 CALIBRATION AND ADJUSTMENTS

4.1 GENERAL

The calibration for the Model 115 has been factory set for optimum performance and should not normally require further calibration or adjustment.

If the need for calibration is suspected, set up the following procedures and observe that voltage and/or degree readings are NOT correct before disturbing the potentiometer settings. Allow 15 minutes for equipment to stabilize after applying power to the unit.

4.2 PRINTED CIRCUIT BOARD REMOVAL

> **WARNING**
>
> Power must be removed from the Model 115, the analog output device, and thermocouple device to remove any potential shock hazards.

1. Unplug power from Model 115 and any analog device or thermocouple attached to it.
2. Observe or make a diagram of how wires are connected to the terminal screws on the rear of both printed circuit boards. Remove screws completely from both boards.

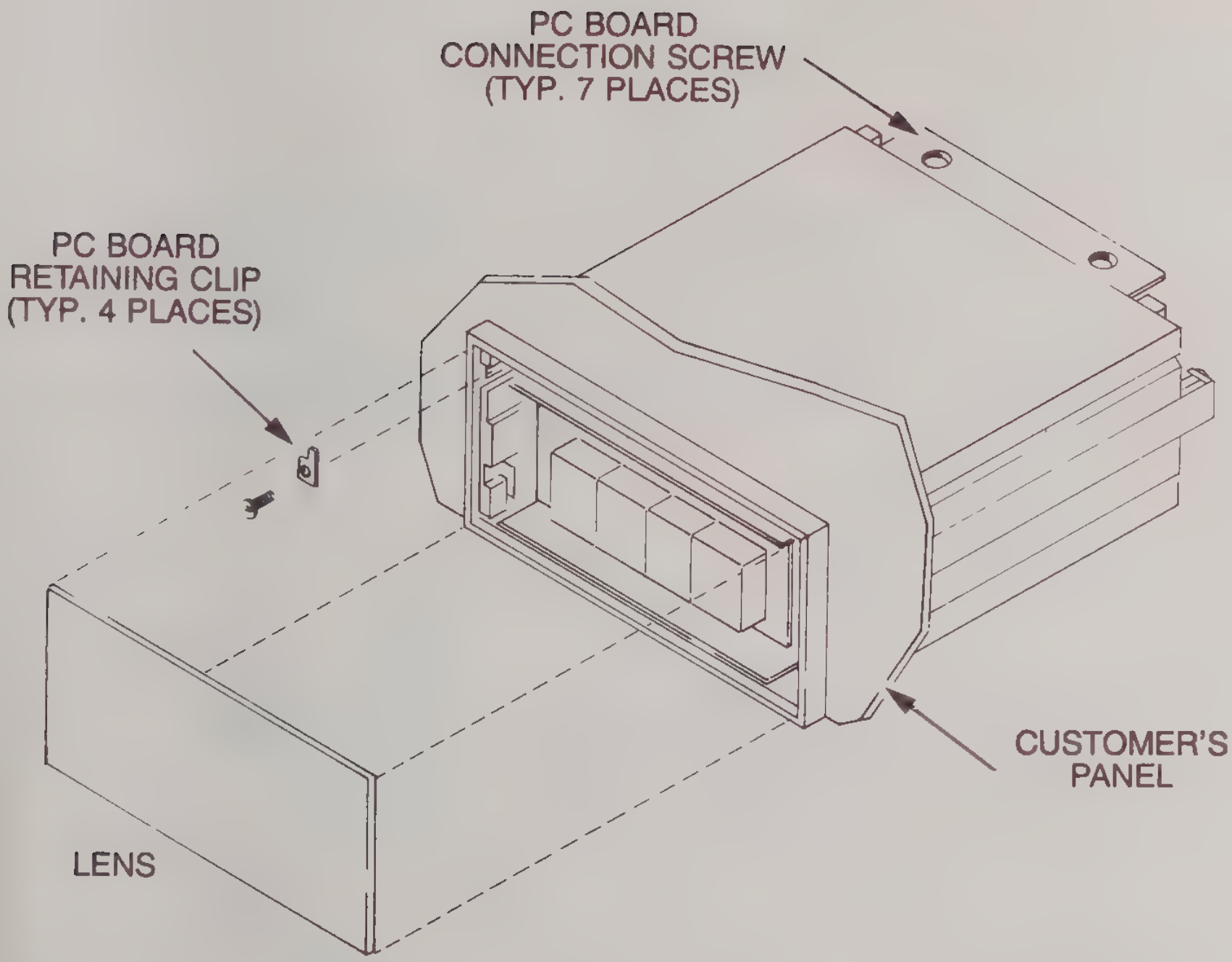


Figure 4-1. Printed Circuit Board Removal

NOTE

It is not necessary to remove the case from mounting panel to gain access to the electronics.

3. Remove lens from case by gently prying center of lens at the notch until the lens pops out of place.
4. Remove electronics package by removing four screws and retaining clips. Slide both printed circuit boards out of case. See Figure 4-1.

4.3 CALIBRATION

NOTE

When using an OMEGA OMNI-CAL™ calibrator, refer to paragraph 4.3.1. For units being calibrated with other millivolt sources, refer to paragraph 4.3.2.

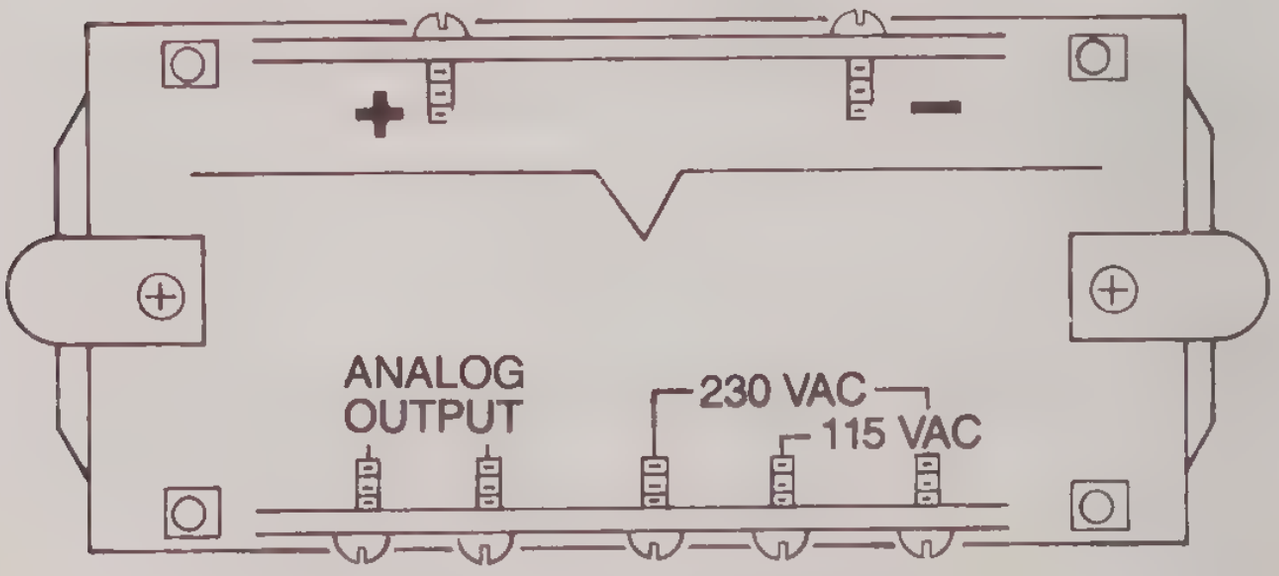


Figure 4-2. Rear Panel Connections

Prior to calibration, allow unit to warm up and stabilize for approximately 15 minutes.

4.3.1 **Using an OMEGA OMNI-CAL™** Calibrator as a Voltage Source.

1. Attach copper test leads from OMNI-CAL™ to TP2 (+) and COM (–). See Figures 4-3 and 4-4. Observe polarity.

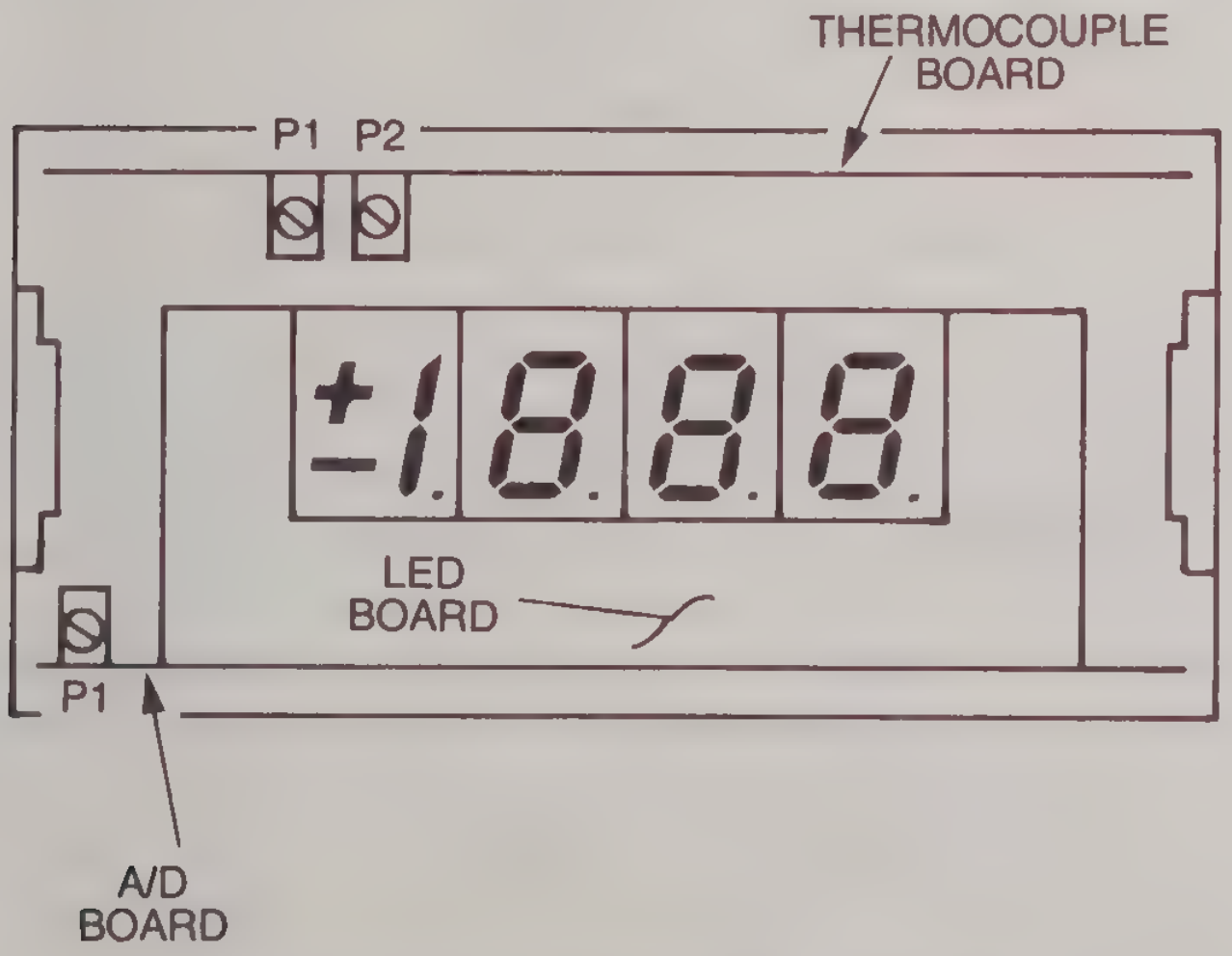


Figure 4-3. Potentiometer Locations.

NOTE

There are two test points marked TP2; both are in the same circuit and can be used interchangeably.

2. Connect ac power leads to the appropriate terminals on the rear of the printed circuit board. Using extreme caution, plug line cord into source voltage.

> **WARNING**
>
> Exposed terminals present a shock hazard.

3. With OMNI-CAL™ set to MEASURE and mV with power on, adjust potentiometer P1 on the thermocouple PC board for −3000 millivolt reading on OMNI-CAL.
4. Unplug line cord and disconnect copper lead wires from TP2 and COM. Attach thermocouple wires (that match unit type) to thermocouple connecting screws on rear of printed circuit board. Refer to Table 2 for polarity.
5. Plug line cord back into source voltage, set OMNI-CAL to read 32°F or 0°C depending on unit, then adjust potentiometer P2 on the thermocouple PC board for 32°F or 0°C on OMNI-CAL.
6. Select input voltage from Table 3 or 4 and adjust potentiometer P1 on the A/D PC board for corresponding reading in degrees.

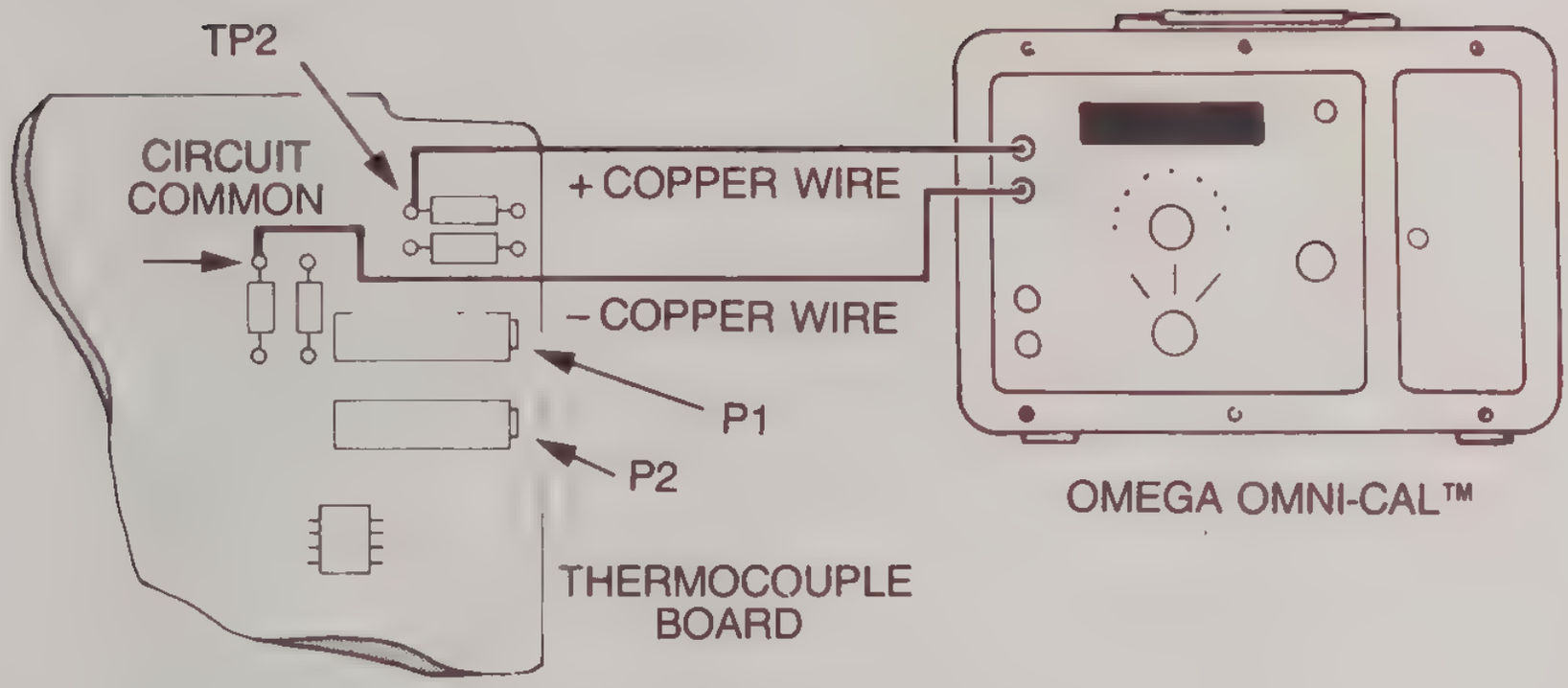


Figure 4-4. Calibration Setup for –3000 mV.

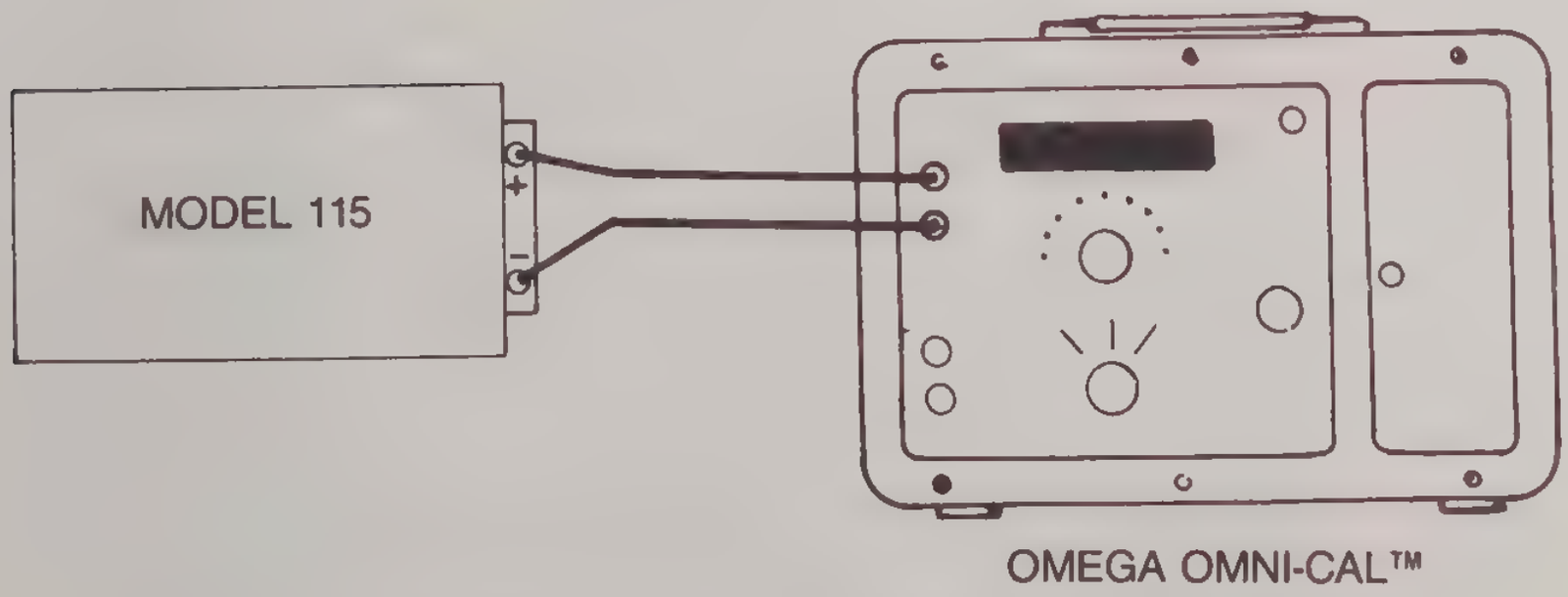


Figure 4-5. Potentiometer P1 Adjustment.

TABLE 3
CELSIUS CALIBRATION

Model	Millivolts	°Celsius
115 JC	42.283	750
115 KC	48.828	1200
115 TC	20.869	400
115 EC	64.147	840

TABLE 4
FAHRENHEIT CALIBRATION

Model	Millivolts	°Fahrenheit
115 JF	42.922	1400
115 KF	44.645	1990
115 TF	20.801	750
115 EF	59.626	1440

4.3.2 Using a Standard Voltage Source.

Equipment Required:

dc millivolt source
digital multimeter or voltmeter
OMEGA TRC Ice Point Reference or material to make a distilled ice water bath as described in paragraph 4.3.3.

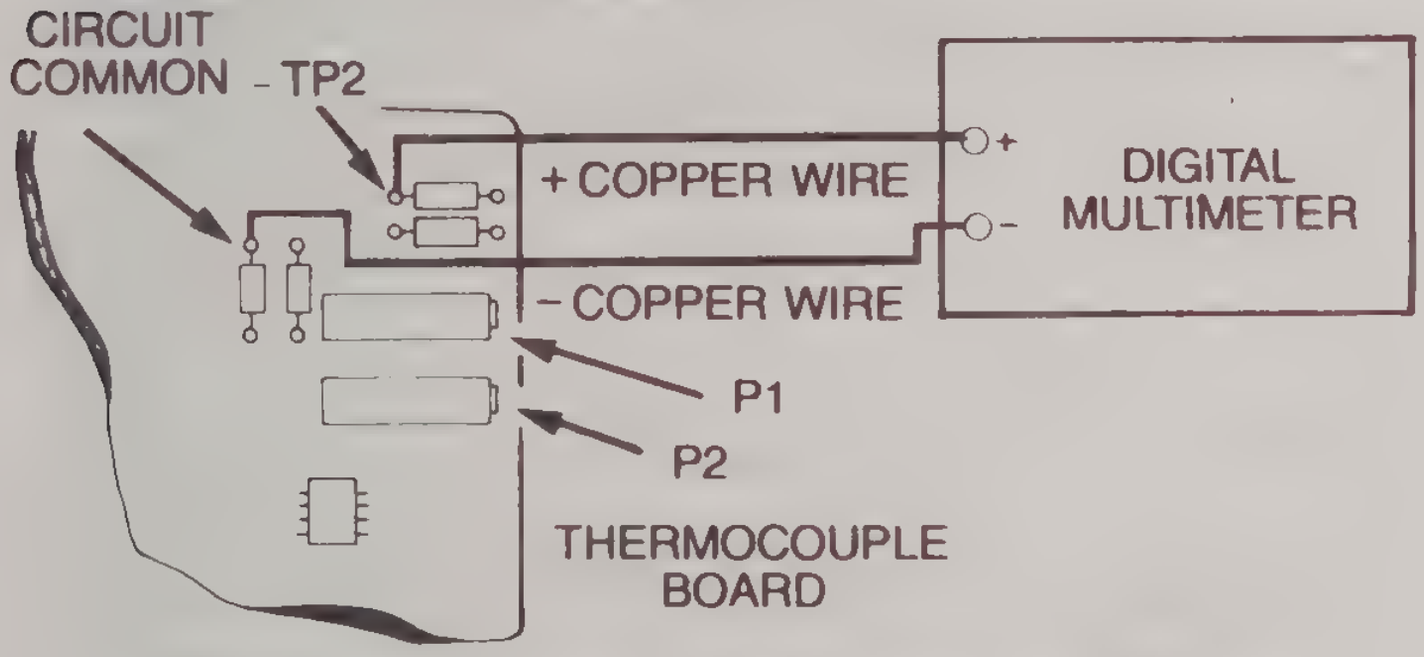


Figure 4-6. Alternate Calibration Setup for –3000 mV.

1. Attach copper test leads from the Digital Multimeter to TP2 (+) and COM (–). See Figure 4-6. Observe polarity.

NOTE

There are two test points marked TP2; both are in the same circuit and can be used interchangeably.

2. Connect ac power leads to the appropriate terminals on the rear of the printed circuit board. Using extreme caution, plug line cord into source voltage.

WARNING

Exposed terminals present a shock hazard.

3. Adjust potentiometer P1 on the thermocouple PC board for −3000 millivolt reading on the digital voltmeter. Unplug line cord, and disconnect the digital voltmeter and copper wires from TP2 and COM.
4. Connect equipment as shown in Figure 4-7. Use an OMEGA® TRC Ice Point Reference or prepare an ice bath as explained in paragraph 4.3.3.

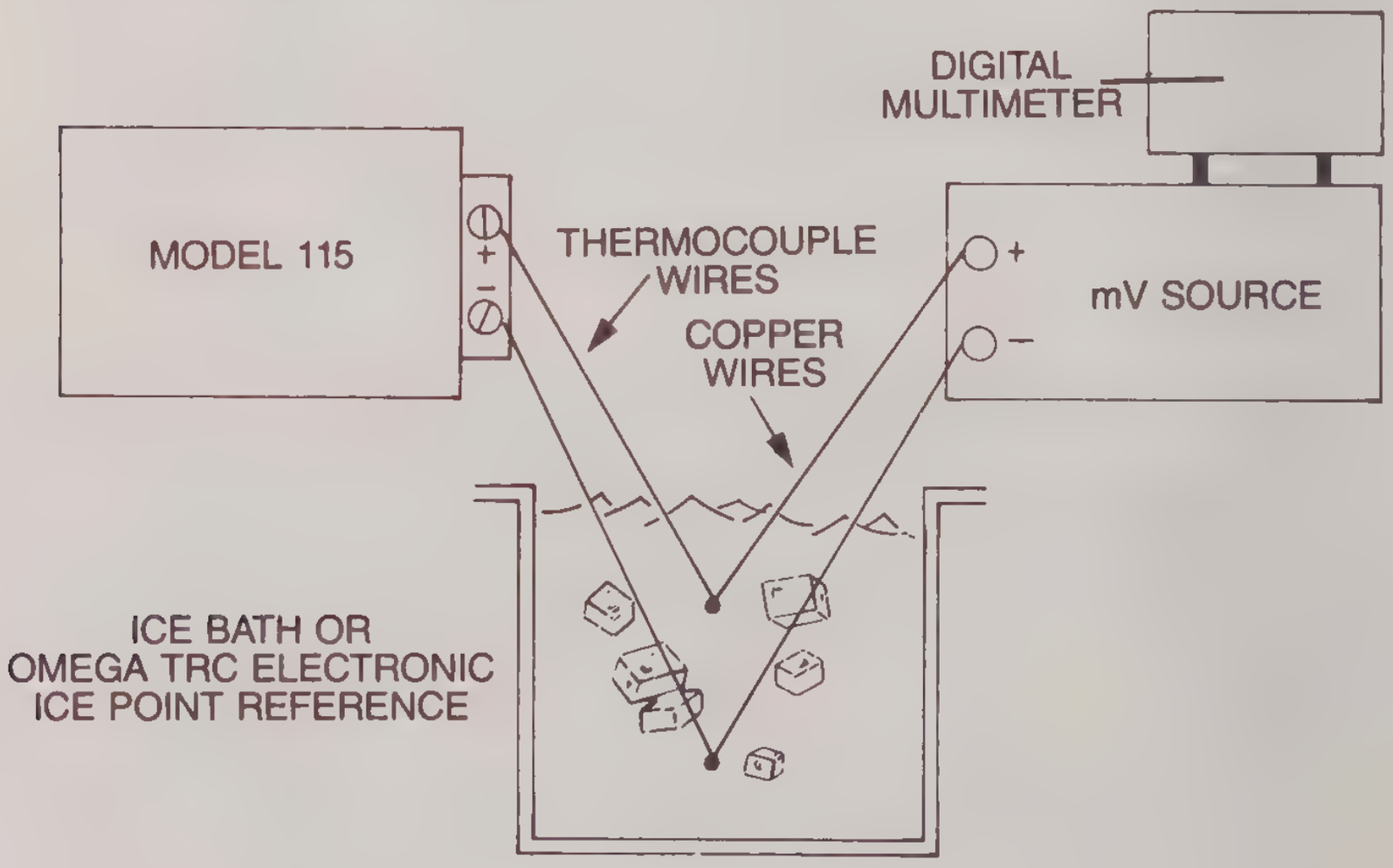


Figure 4-7. Ice Bath Setup.

5. Attach thermocouple wires (that match unit type) to thermocouple connecting screws on rear of printed circuit board. Refer to Table 2 for polarity.
6. Plug line cord back into source voltage, set voltage source to zero millivolts, and adjust potentiometer P2 on the thermocouple PC board for 0°C or 32°F.
7. Input proper voltage selected from Table 3 or 4 and adjust potentiometer P1 on the A/D PC board for corresponding reading in degrees.

4.3.3 Ice Bath Setup

1. To make a thermocouple transition junction, silver solder a piece of copper wire to each thermocouple wire and insulate the junction with a waterproof jacket.
2. Connect the copper wires to the millivolt source and digital voltmeter as shown in Figure 4-7.
3. Prepare a distilled water ice bath as follows: (or use an OMEGA TRC Ice Point Reference).
4. Drill a hole in the cap of a Dewar flask or Thermos™ bottle to accommodate the transition junction.
5. Firmly pack the flask with pea-size ice chips made from distilled water and then fill the flask with distilled water. Tap water may cause inaccuracies due to contaminants.
6. Replace the melted ice with more ice while removing the excess water.
7. Place cap on the flask and insert the transition junction into the flask. Allow 20 minutes for temperature stabilization.

4.4 PRINTED CIRCUIT BOARD REPLACEMENT

1. Replacement is accomplished by simply reversing the procedure in paragraph 4.2. Ensure that ribbon cable connector between boards is firmly in place before replacing electronics in case.

SECTION 5 SERVICE INFORMATION

5.1 TROUBLESHOOTING

The troubleshooting information, along with appropriate schematics and parts lists, are included to serve as a guide to enable equipment repair. The schematics and parts lists may vary slightly from actual production units and are to be used as a guide only. Likewise, the troubleshooting section is a guide only and cannot cover all possible contingencies that may occur.

Each Model 115 is covered by a 12-month warranty as described on the inside front cover of this manual. Warranty will be void if the unit shows evidence of having been tampered with.

If an instrument requires repair, whether in or out of warranty, call OMEGA Customer Service Department (203) 359-1660 for an Authorized Return (AR) number and instructions for returning to factory.

	SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
1.	Meter appears to be counting in sequence	Open thermocouple	Repair or replace thermocouple.
2.	Display shows numeral 1	Open thermocouple	Repair or replace thermocouple.
3.	Erratic temperature displays	Improper grounding	Refer to paragraph 2.3 for proper grounding instructions.

4.	Analog device not working properly	Improper grounding	1. Refer to paragraph 2.3 for proper grounding instructions. 2. Improper input impedance of analog device. Minimum input impedance must be 10k ohm.

5.2 SCHEMATICS

Figure 5.1 shows an A/D board schematic for the Model 115 JC. All models have similar circuitry, however, the component values may change. Therefore, only one typical schematic has been reproduced. Refer to the individual board parts list for component values.

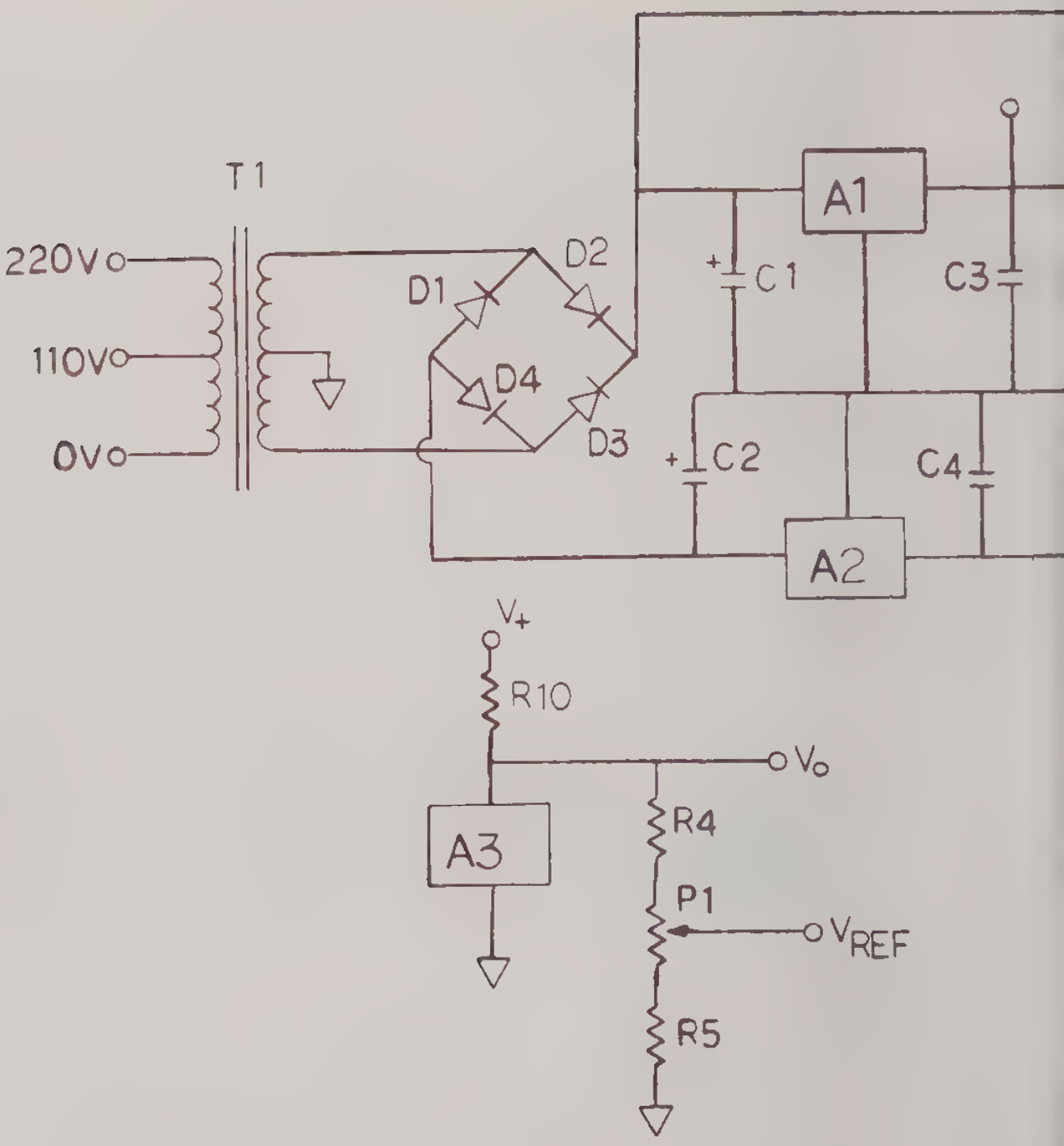
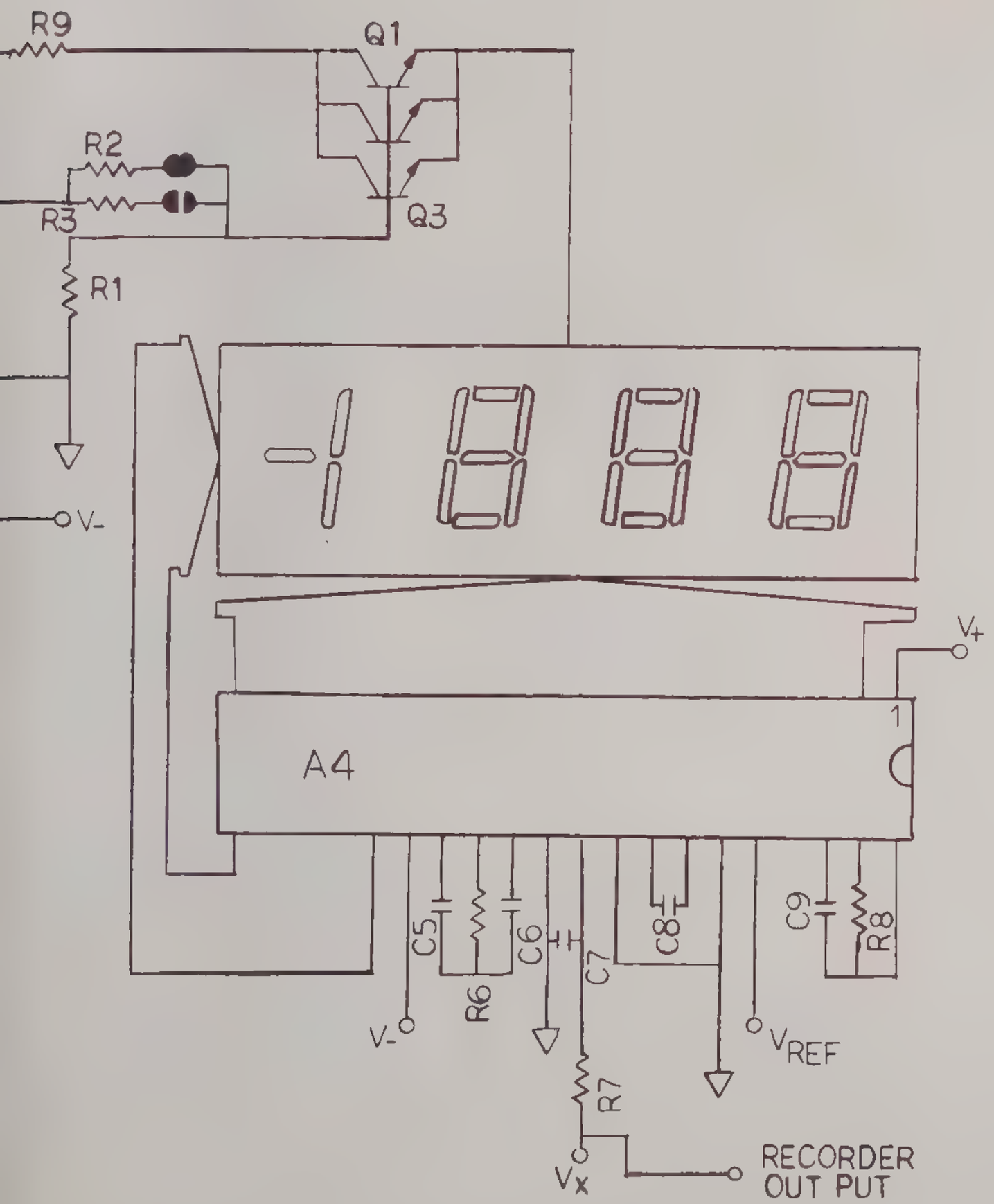


Figure 5-1. A/D Board Schematic


R9
Q1
R2
R3
Q3
R1
V-
V+
A4
1
C5
R6
C6
C7
C8
C9
R8
V-
VREF
R7
Vx
RECORDER
OUT PUT

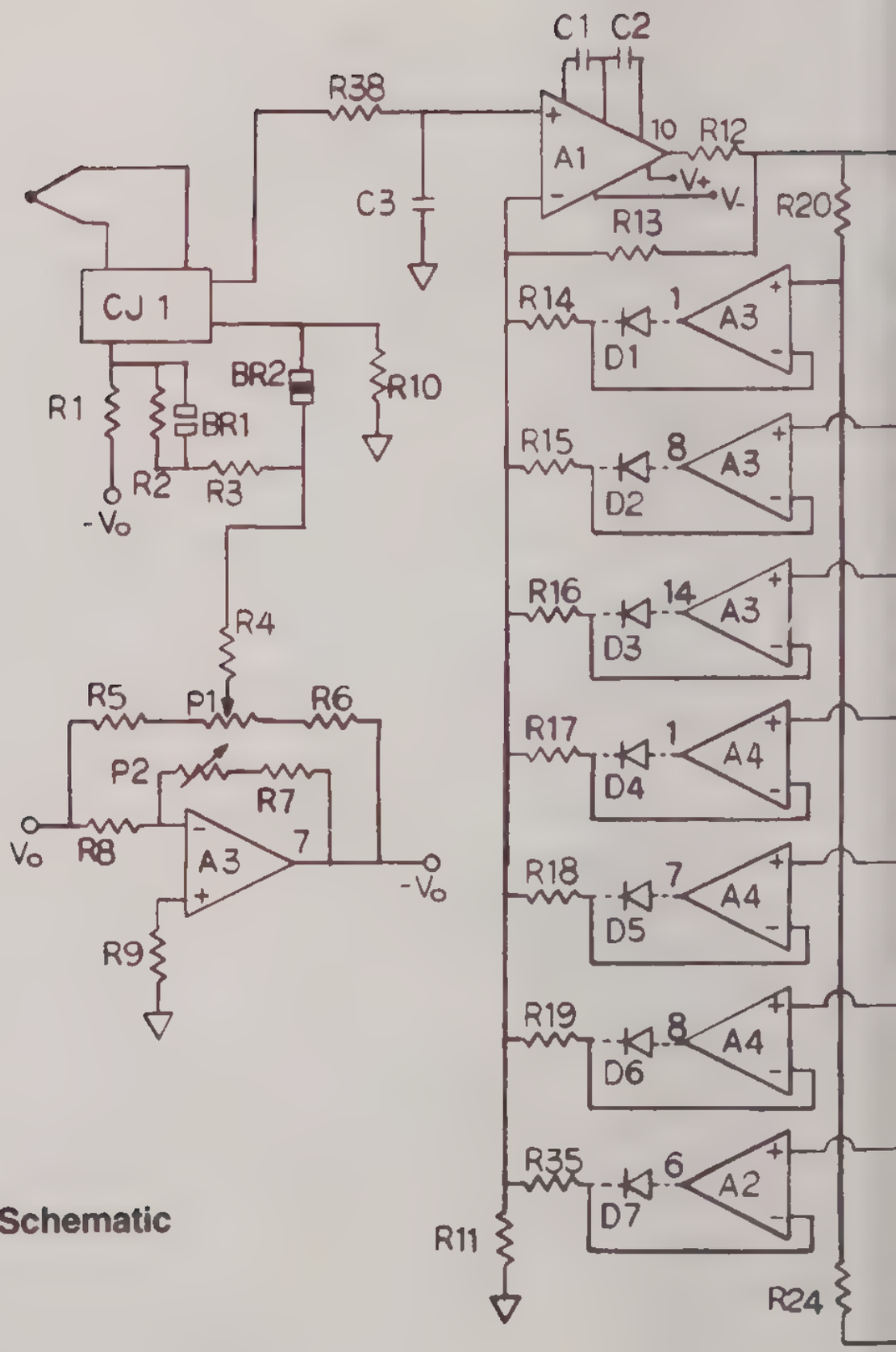
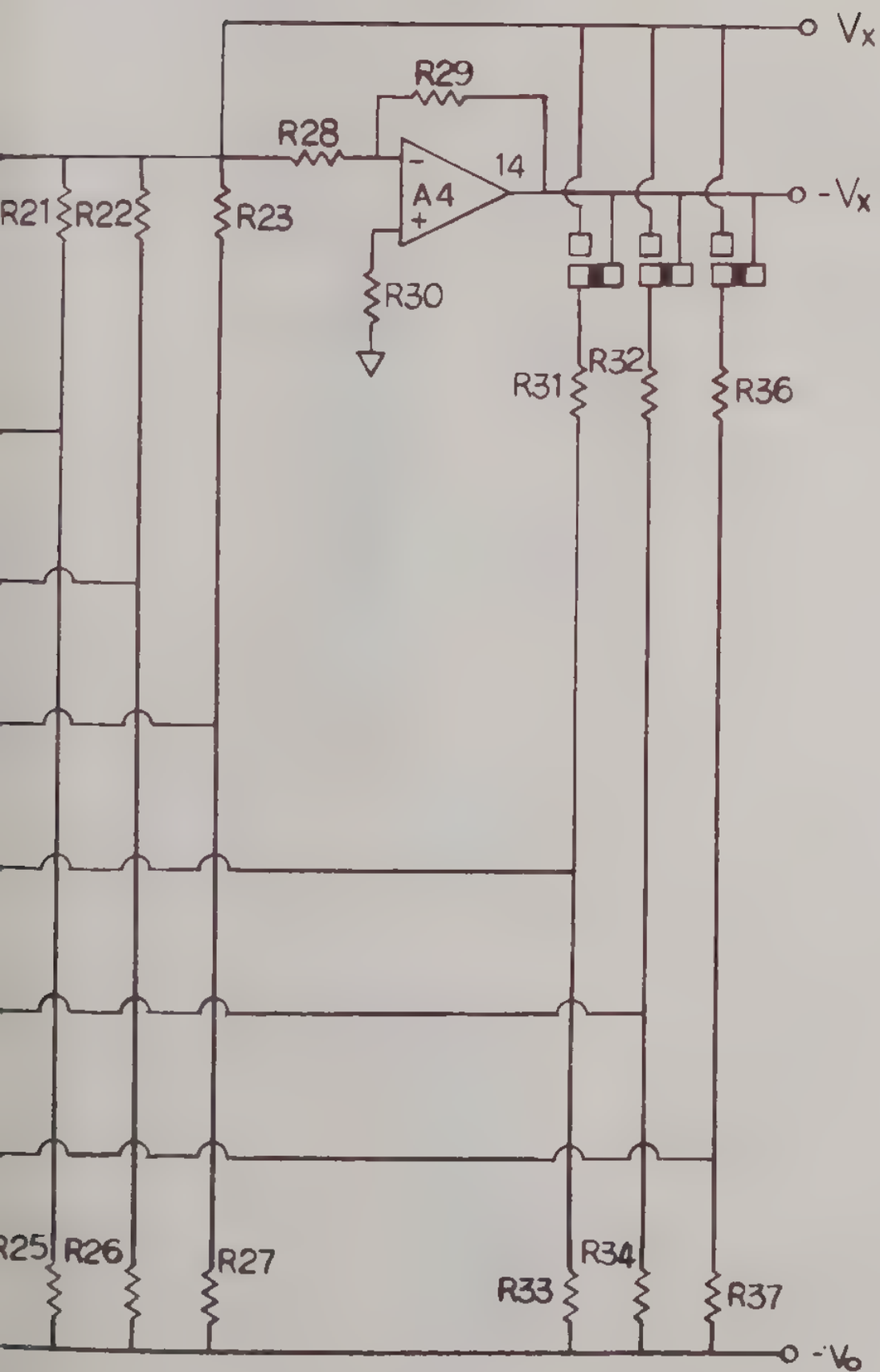


Figure 5-2. Thermocouple Board Schematic


Vx
R29
R28
14
A4
-Vx
R21
R22
R23
R30
R31
R32
R36
R25
R26
R27
R33
R34
R37
-Vo

5.3 PARTS LISTS

5.3.1 A/D Printed Circuit Board. See Figure 5-3.

Resistors

Component Number	Celsius	Fahrenheit
R1	120K	120K
R2	1.5K	1.5K
R3	2.7K	2.7K
R4*	15K	15K
R5*	10K	4.32K
R6	120K	240K
R7	1M	1M
R8	100K	100K
R9	10	10
R10	2.7K	2.7K

*1%, remainder 5%

Capacitors

Component Number	All Models
C1	330μF, 16V
C2	100μF, 16V
C3	0.1μF
C4	0.1μF
C5	0.22μF
C6	0.1μF
C7	0.01μF
C8	0.1μF

Integrated Circuits

Component Number	All Models
A1	78L05
A2	79L05
A3	LM336
A4	ICL7107

Transistors

Component Number	All Models
Q1	2SC1815
Q2	2SC1815

Diodes

Component Number	All Models
D1	1N4002
D2	1N4002
D3	1N4002
D4	1N4002

Potentiometer

Component Number	All Models
P1	1 kohm, 15-turn

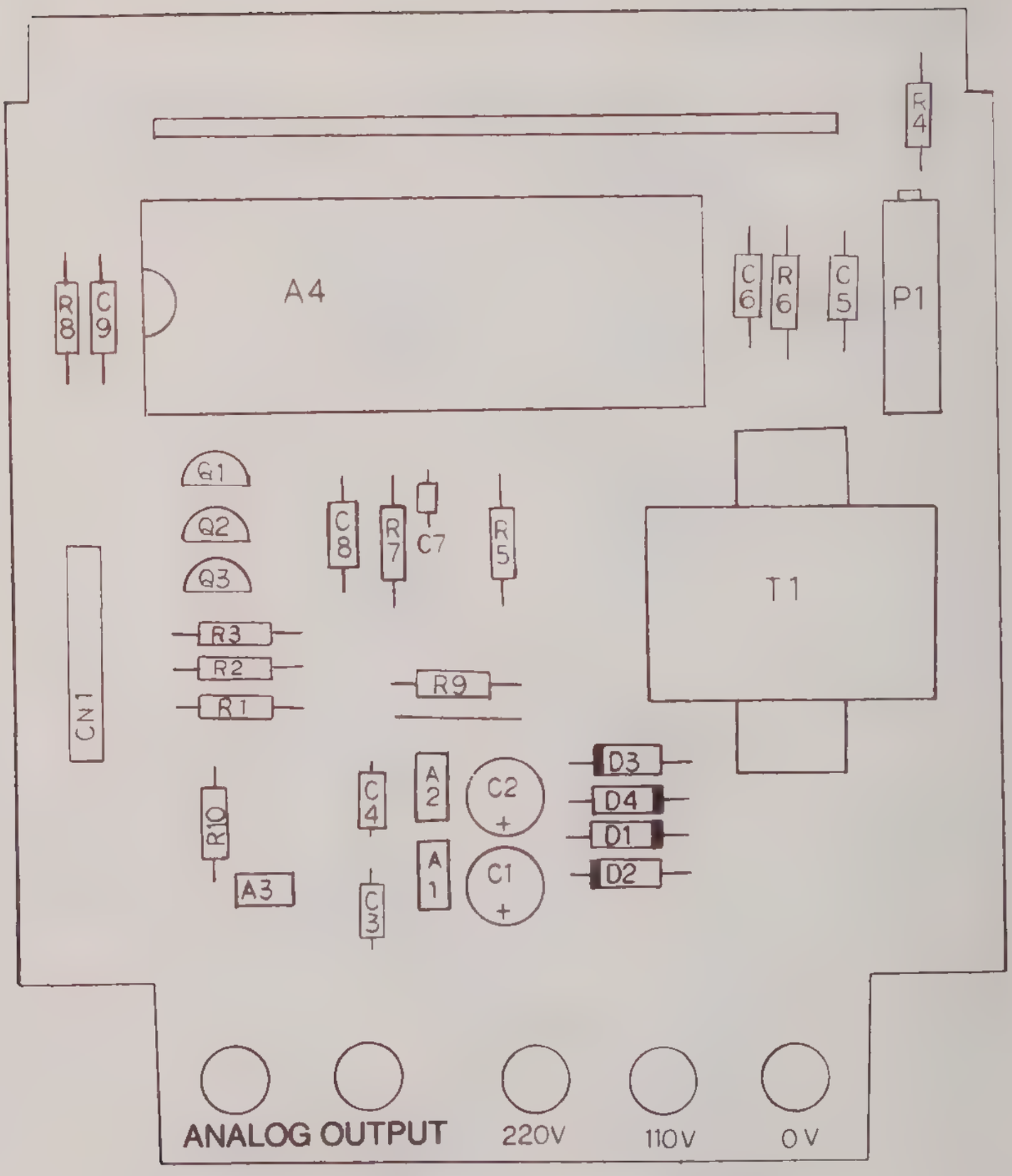


Figure 5-3. A/D Board Component Parts Layout

5.3.2 Thermocouple Printed Circuit Board. See Figure 5-4.

Diodes

Component Number	All Models
D1	1N4148
D2	1N4148
D3	1N4148
D4	1N4148
D5	1N4148
D6*	1N4148
D7**	1N4148

*not TF model **not JF or TF models

Capacitors

Component Number	All Models
C1	0.22μF
C2	0.22μF
C3	0.1μF

Variable Resistors
(15-turn pots)

Component Number	JC	JF	KC	KF	TC	TF	EC	EF
P1	1K	1K	1K	1K	10K	10K	10K	10K
P2	1K	1K	1K	1K	1K	1K	1K	1K

Resistors

COMPONENT NUMBER	JC	JF	KC	KF	TC	TF	EC	EF
R1	19.7K	18.7K	19.6K	19.6K	19.6K	19.6K	17.8K	17.8K
R2	470	470	470	470	470	470	470	470
R3	20K	20K	25.5K	25.5K	25.5K	25.5K	16.9K	16.9K
R4	69.8K	69.8K	100K	100K	82.5K	82.5K	56.2K	56.2K
R5	—	—	12K	4.32K	—	—	—	—
R6	100K	100K	69.8K	69.8K	69.8K	200K	200K	—
R7	11.8K	11.8K	11.8K	11.8K	11.8K	11.8K	11.8K	11.8K
R8	10K	10K	10K	10K	10K	10K	10K	10K
R9*	5.6K	5.6K	5.6K	5.6K	5.6K	5.6K	5.6K	5.6K
R10	470	470	470	470	470	470	470	470
R11	470	470	470	470	470	470	470	470
R12	1K	1K	1K	1K	1K	1K	1K	1K
R13	9.09K	9.09K	13K	12.7K	12K	12K	7.32K	7.87K
R14	110K	120K	258K	681K	69.8K	100K	64.5K	110K
R15	187K	162K	3.9M	232K	82.5K	64.5K	69.8K	90.9K
R16	110K	178K	232K	232K	56.2K	69.8K	69.8K	64.5K
R17	82.5K	64.5K	232K	232K	82.5K	69.8K	162K	82.5K
R18	82.5K	200K	226K	200K	90.9K	90.9K	681K	82.5K
R19	120K	100K	200K	470K	120K	—	90.9K	332K
R20	36.5	36.5	976	470	90.9	105	154	39.2
R21	340	340	1.13K	909	274	316	365	182
R22	1.65K	1.65K	2.29K	2.29K	590	590	781	365
R23	2K	2K	2.74K	2.74K	1K	909	1K	590
R24	10K	10K	10K	10K	10K	10K	10K	10K
R25	10K	10K	10K	10K	10K	10K	10K	10K

Resistors
(Continued)

R26	10K	10K	10K	10K	10K	10K	10K	10K
R27	10K	10K	10K	10K	10K	10K	10K	10K
R28	30.1K	30.1K	30.1K	30.1K	30.1K	30.1K	30.1K	30.1K
R29	30.1K	30.1K	30.1K	30.1K	30.1K	30.1K	30.1K	30.1K
R30*	15K	15K	15K	15K	15K	15K	15K	15K
R31	154	154	3.16K	3.16K	90.9	39.5	1.5K	1K
R32	316	182	3.61K	2K	274	—	—	1.27K
R33	10K	10K	10K	10K	10K	10K	10K	10K
R34	10K	10K	10K	10K	10K	10K	10K	10K
R35	64.5K	—	150K	150K	100K	—	100K	178K
R36	464	—	—	—	422	—	154	51.1
R37	10K	10K	10K	10K	10K	—	10K	10K
R38	680K	680K	680K	680K	680K	680K	680K	680K

*5%, remainder 1%

Integrated Circuits

Component Number	All Models
A1	ICL7650
A2*	LM 741
A3	LM 324
A4	LM 324

* not TF models

Transistors (NPN)

Component Number	All Models
Q1	MTS105

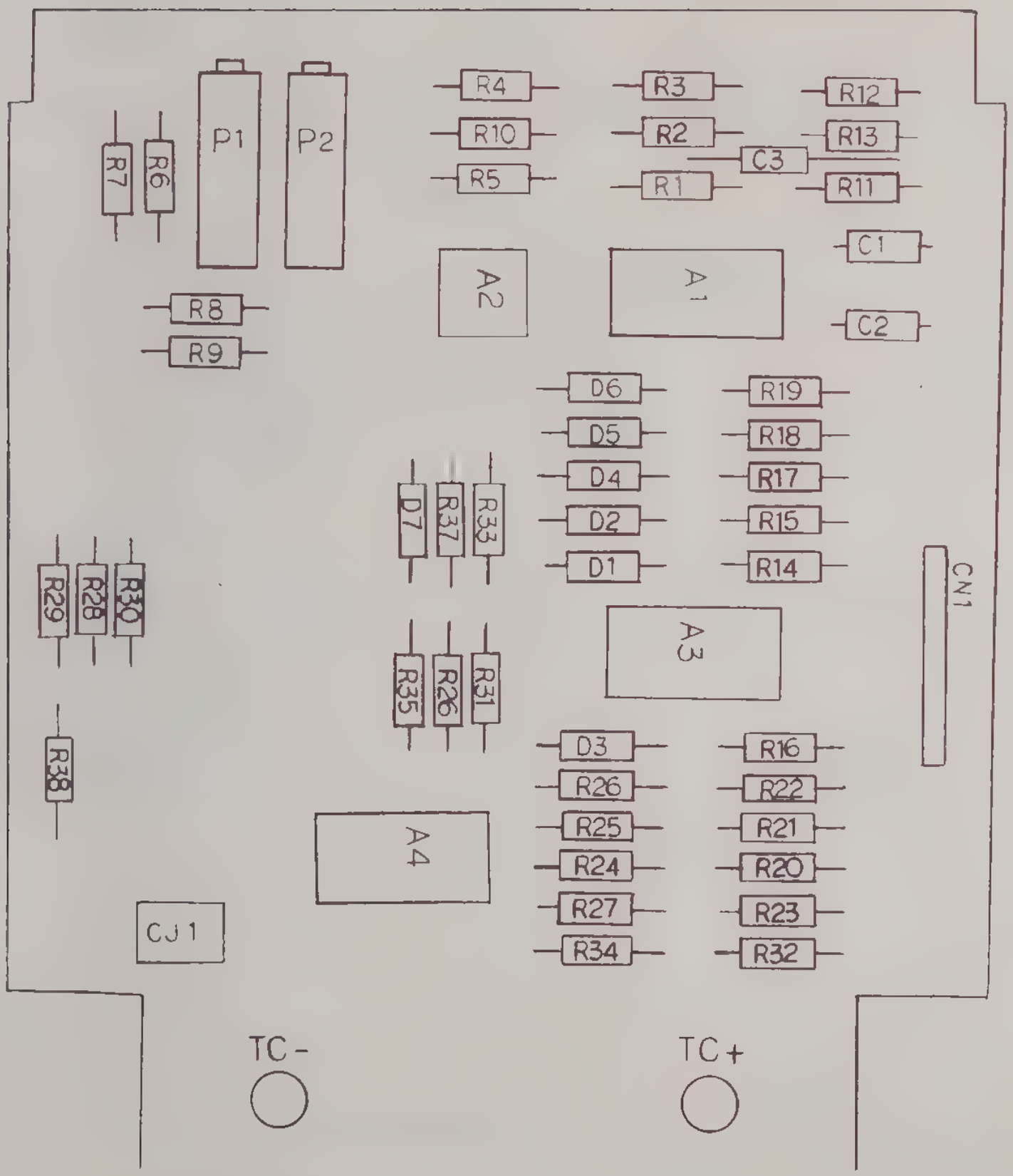


Figure 5-4. Thermocouple Board Component Parts Layout.

5.3.3 Display Printed Circuit Board

LED	
Component Number	All Models
D5	HDSP 5507
D6	HDSP 5501
D7	HDSP 5501
D8	HDSP 5501

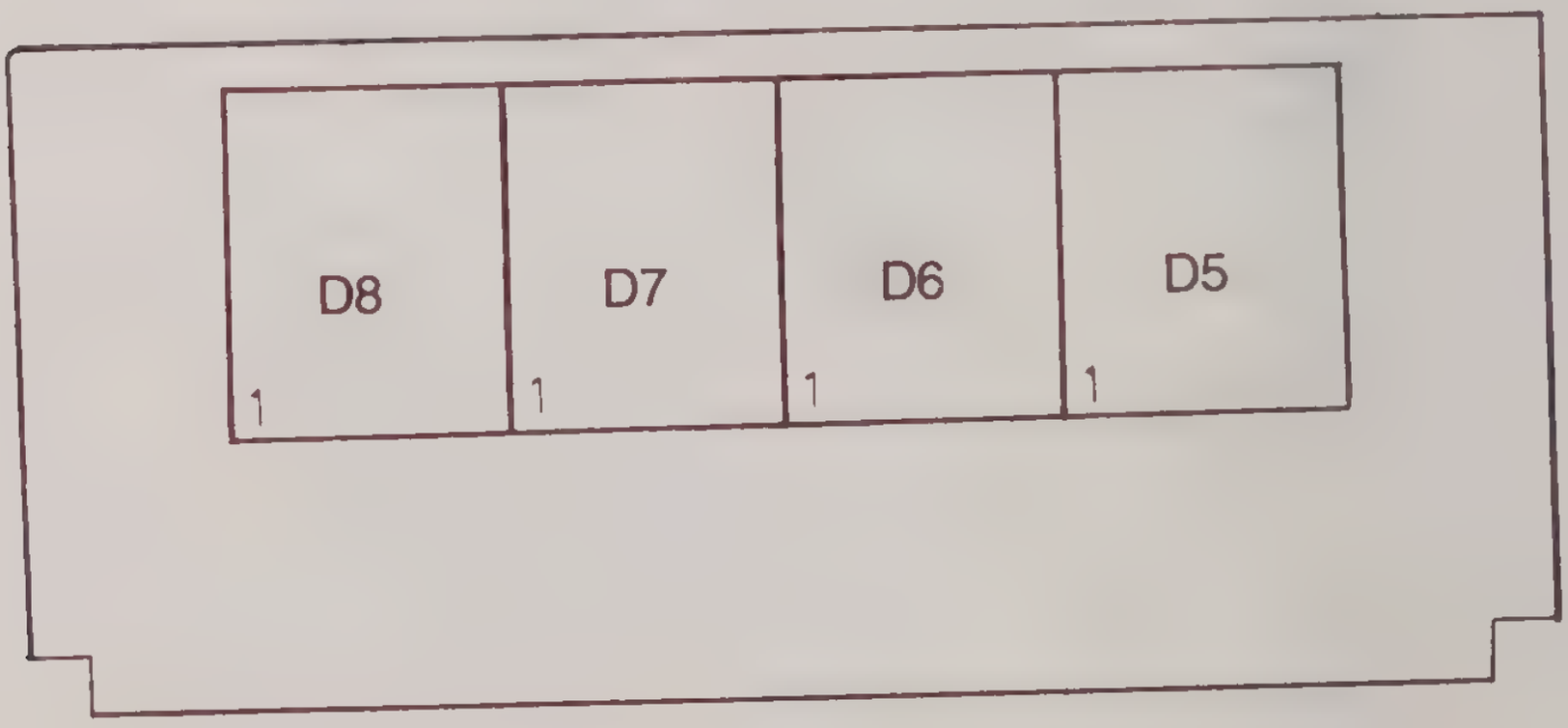


Figure 5-5. Display Segments

SECTION 6 SPECIFICATIONS

THERMOCOUPLE TYPES:	J, K, T, or E
COLD JUNCTION COMPENSATION:	0.05°F/°F (0.05°C/°C) ambient of 32 to 104°F (0 to 40°C)
INPUT IMPEDANCE:	Greater than one megohm
INPUT CURRENT:	10 nA
OPEN THERMOCOUPLE:	Plus or minus overrange, + 1xxx or − 1xxx (x = blank)
COMMON MODE REJECTION RATIO:	120 dB
COMMON MODE VOLTAGE:	240 RMS max
RESOLUTION:	1°C or 1°F
READOUT ACCURACY:	See Table 1
OUTPUT ACCURACY:	±0.5% span
OPERATING VOLTAGE:	117 V ac or 230 V ac ± 15%, 50 or 60 Hz

SPECIFICATIONS continued

POWER CONSUMPTION:	1.75 Watts
OPERATING TEMPERATURE:	32° to 104°F (0° to 40°C)
STORAGE TEMPERATURE:	14° to 122°F (−10° to +50°C)
OUTPUT:	Analog, 1 mV/°C or 0.556 mV/°F (0°F = 0 mV) Analog device must have input impedance of 10 K Ω
DISPLAY:	0.56 inch high LED
DIMENSIONS:	H: 1.9″ (48 mm) × W: 3.8″ (97 mm) × D: 4.13″ (105 mm) DIN/NEMA standard
WEIGHT:	12.35 oz. (350 g)

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